

2000 12



2000 12

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I. 1

• 3

1. 3

2. 3

1) Stock 3

2) 3

3) 4

4) 4

5) 5

6) 5

7) 6

• 7

1. 7

2. 7

• 11

• 17

..... 18

..... 23

Table 1. The composition of remineralization solution 4

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가 .

: , , ,

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가

,

가

39, 46)

.

,

,

.

,

34)

.

가

가

가

30). Chow 30) calcium phosphate 8, 13.

Ca²⁺ calcium

phosphate, 50) Heilman 24, 25)

가

transversal

microradiography (TMR)가 (100μm)

(confocal laser scanning microscopy)

Gonzalez Fontana 17, 21)

microradiography

, microradiography Z

area of the fluorescent lesion, total fluorescence of the

lesion, average fluorescence of the lesion

가

•

1.

가 가 20 ,
가 pumice debris
가 가
#330 bur 3mm × 2mm × 2mm(가 × ×)
, 37% 15 10 ,
Prime & Bond NT (Dentsply, U.S.A.) Spectrum (Dentsply,
U.S.A.) fine grit diamond bur finishing ,
white stone, white rubber .

2.

1) Stock

30% lactic acid(Sigma Co., 90.08, 1.080) 1M lactic acid

CaCl₂(Sigma Co., 147.0) 0.3M

(747 Automatic analyzer, Hitachi, Japan)

K₃PO₄(Sigma Co., 136.1) 0.9M ,

(747 Automatic analyzer, Hitachi, Japan)

2)

Stock Ca 15mM, P 9.5mM, Sodium azide 3.08mM, lactic acid 100mM, 0.1555가 8N KOH

Table 1. The composition of remineralization solution

Composition	Concentration
Lactic acid	10mM
Calcium	37.4mM
Phosphate	15.0mM
Sodium azide	3.08mM
Fluoride	2ppm
pH	4.3
Degree of Saturation	0.38999

pH 4.3 (747 Automatic analyzer, Hitachi, Japan) Ca P

3) 100ppm (100ppm NaF Standard solution, Orion Research Inc., U.S.A.) stock 2ppm (Table 1), (747 Automatic analyzer, Hitachi, Japan)

4) 가 가
20M가 50
M 가
25 48 low
speed diamond saw (ISOMET™, Buehler, U.S.A.)
occlusal ½ 0.8- 1.0mm

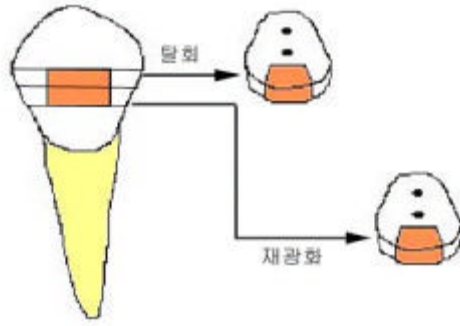


Fig 1. The procedure of tooth sample preparation

. (Fig 1)

5)

Scotchbond Multipurpose bonding resin(3M, U.S.A.)
 가 . 20 10 2
 group 50Mℓ
 20Mℓ 가 25 group 1
 , group 2 .
 bonding resin #800
 low speed diamond saw (ISOMET™, Buehler, U.S.A.) ,
 cervical ½
 0.8- 1.0mm .(Fig 1)

6)

group 1,2 20 deionized water 2
 slide glass sticky wax .
 0.1mM rhodamine B 1 1
 . Bio-Rad MRC 600 confocal argon-crypton laser(Glattbrugg,

Switzerland)가 Leica^{ca} DMRBE microscope ,
TCS NT system (Hidelberg, Germany) ,
pixel intensity total fluorescence of
the lesion area fluorescent pixel value average
fluorescence of the lesion 가 parameter .
488nm excitation wave length 가 argon laser
confocal slit 15 μ m 515nm FITC barrier
. contrast brightness .

7)

SPSS 8.0 program Wilcoxon signed
rank test 1, 2 .

•

20

area pixel intensity total fluorescence of the lesion(TFL)
 area fluorescent pixel value average fluorescence of
 the lesion(AFL)

1.

20, total
 fluorescence of the lesion average fluorescence of the lesion
 .(1-4) Total fluorescence of the lesion average fluorescence of the
 lesion graph
 . total fluorescence of the lesion $2.57 \pm 1.11 (\times 10^6)$,
 average fluorescence of the lesion 84.07 ± 43.14

2.

1 2 total fluorescence of the lesion
 1 34.31% fluorescence가 , 2
 50.79%
 Average fluorescence of the lesion 1 33.56%
 , 2 47.56%
 Wilcoxon signed rank test
 1 2 total
 fluorescence of the lesion average fluorescence of the lesion
 (p<0.01).

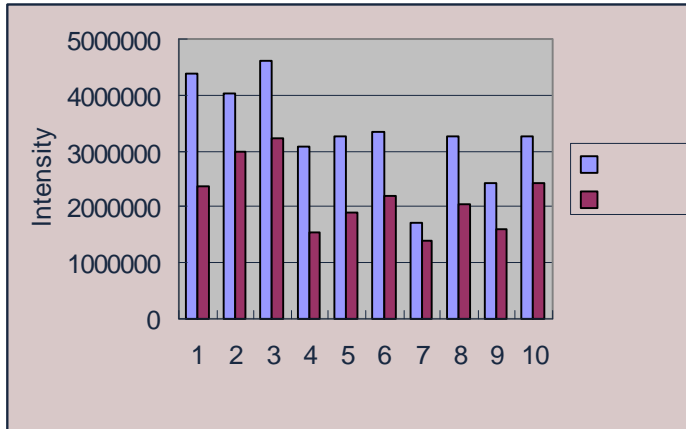


Fig 2. The change of TFL in one week remineralization group

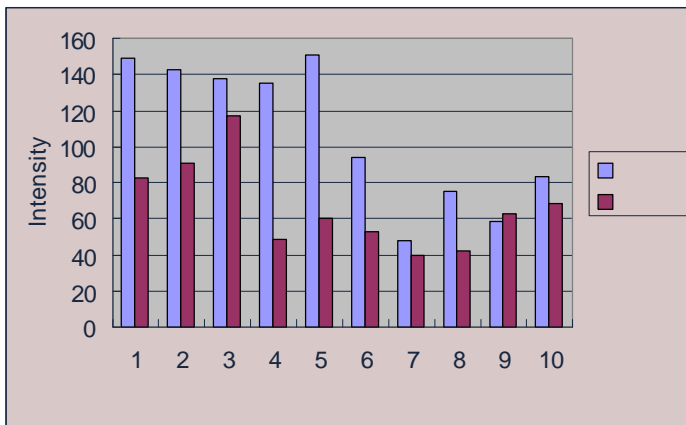


Fig 3. The change of AFL in one week remineralization group

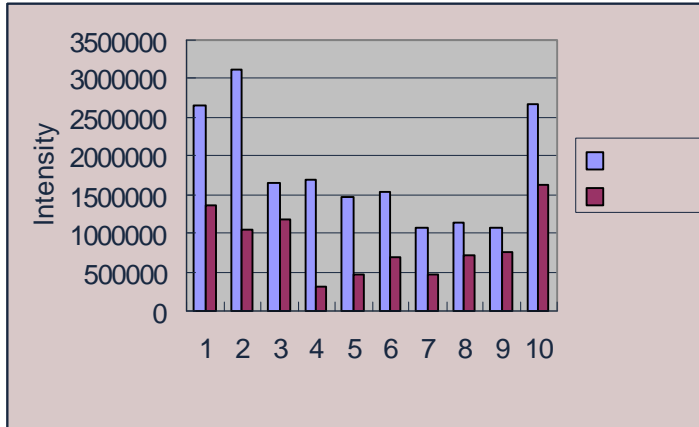


Fig 4. The change of TFL in two weeks remineralization group

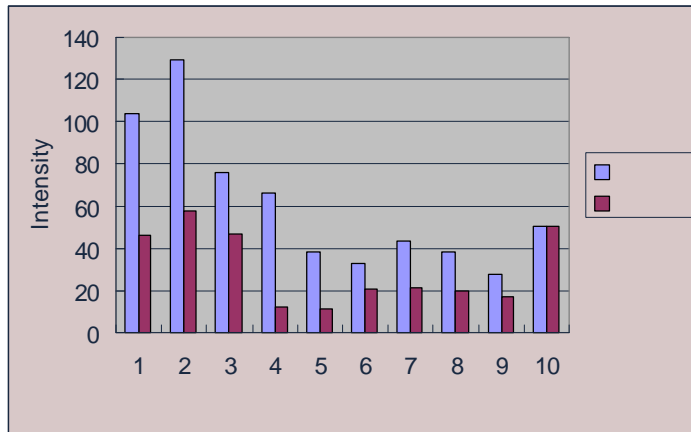


Fig 5. The change of AFL in two weeks remineralization group

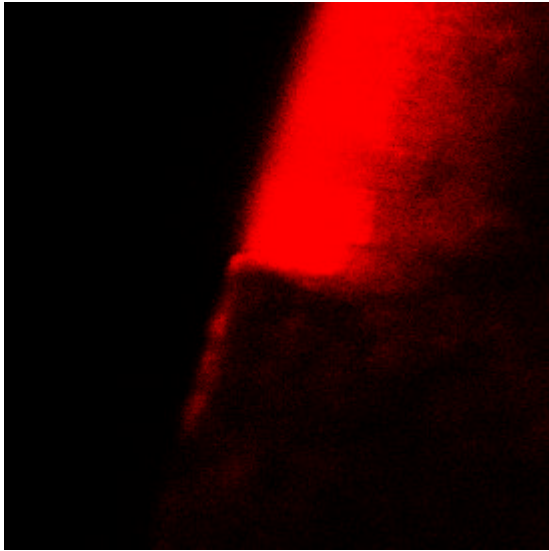


Fig 6. The CLSM image of demineralized tooth sample

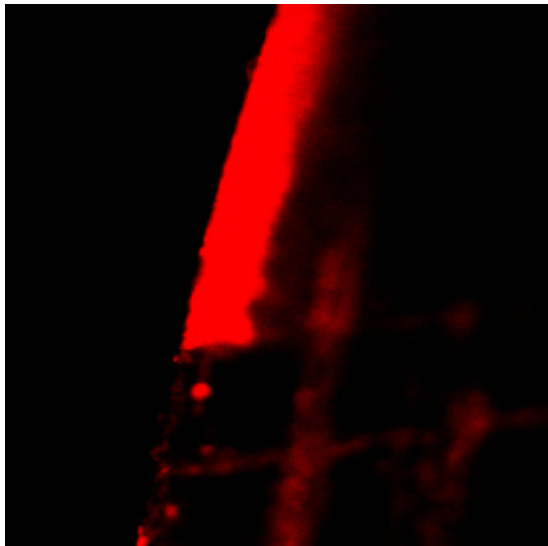


Fig 7. The CLSM image of remineralized tooth sample

가
 , pH^{43, 45, 47, 48} ,¹³⁾
 ,^{50, 51)}
 (surface layer) 가
 (subsurface layer) . 1935 Hollander
 Saper
 Moreno³⁴⁾
 pellicle . pH가
 가 CaHPO₄ ·
 2H₂O (DCPD) Ca₅F(PO₄)₃ (FA) enamel, DCPD, FA 가
 solid phase , (surface pore)
 fluid . 3가 solid phase
 , pore acid buffer
 (chemical potential)
 ,
 phase
 (surface layer)
 (subsurface layer)
 가
 in vitro

acidified gel^{24, 37)}, partially saturated buffer³⁴⁾, surface dissolution inhibitor¹⁵⁾,⁴⁹⁾ partially saturated buffer⁴⁸⁾ .

가

partially saturated buffer .

pH⁴⁷⁾⁾, ,

가 4.3

, ,

Boyle⁷⁾ 20 37

가 25 .

⁵⁰⁾ 1, 2, 4ppm 2ppm

가 가 , 2ppm ,

pH가 4.3 ,⁴⁵⁾

pH가 가 , pH

가 가 .

가

microhardness⁵⁾, cross-section

microhardness^{10, 16)}, polarized light microscopy³⁶⁾, different

microradiography techniques²⁶⁾, iodine absorptiometry¹⁾, light scattering⁴⁰⁾

. 가 , transversal microradiography

가 , 가

. 100 μ m

, x-ray , ,

가 .

(confocal laser scanning

microscopy) cell labeling ,

in vivo¹⁷⁾ .

가

가

¹⁷⁾,

²¹⁾.

transversal microradiography ,

subsurface image

가 ,

3

²⁰⁾,

19, 20)

가

^{18, 44)}.

tetracycline, alizarin red

가

가

brilliant sulfaflavine,

, Benn

Watson rhodamine B

⁶⁾, Gonzalez

rhodamine B

,

, 0.1mM

1

가

가

^{17, 18, 21)}

0.1mM rhodamine B

.

(smear layer)

scanning

10-50 μ m

artifact

,

가

.

Gonzalez Fontana

(1) area of the fluorescent lesion :

0 fluorescence threshold

pixel

(2) total fluorescence of the lesion:

pixel intensity (3) average fluorescence of the lesion:
 fluorescent pixel value 가
 microradiography Z area of the fluorescent
 lesion 가 , total fluorescence of the lesion
 , average fluorescence of the lesion 가

^{17, 21, 23)} TCS NT system (Hidelberg, Germany)

area of the fluorescent lesion ,
 가

20 , 가

Angela²⁾ resin modified glass ionomer

microradiography

가 가 ,

가

intensity

8

intensity

surface layer가

intensity

가 가

intensity

intensity

rhodamine B 가

transversal microradiography

가

pH,

가

가

가

thermocycling

cyclic load

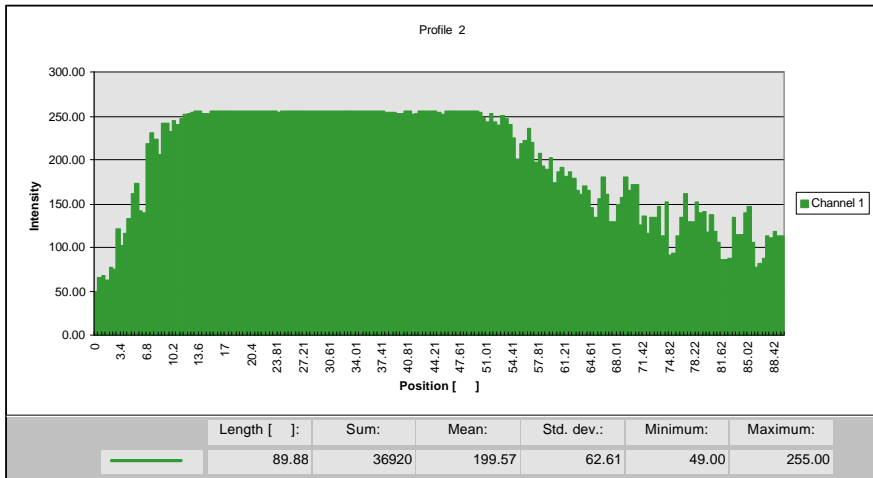


Fig 8. The change of intensity on the demineralized enamel

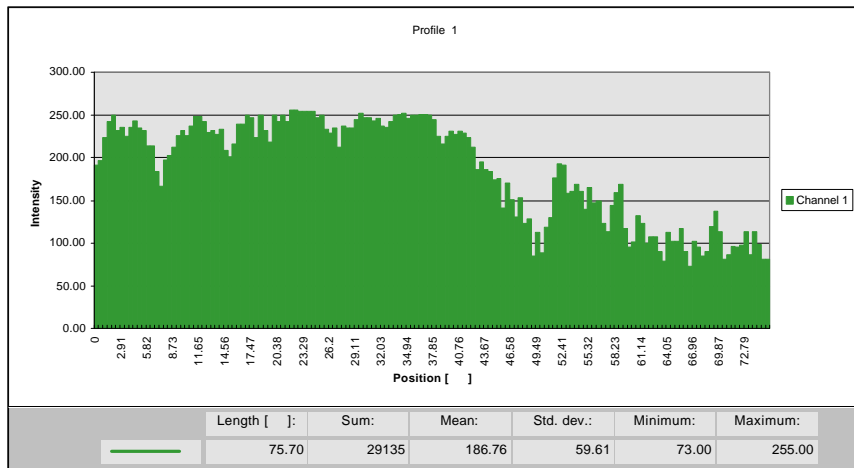


Fig 9. The change of intensity at the resin-enamel interface

•

,

. 20 10
 1 1 , 2 2
 image .

1. ,
 total fluorescence of the lesion average fluorescence of the lesion
 . (p<0.01)

2. 가 .

,
 가 .

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ABSTRACT

Quantitative analysis of mineral change in the initial carious lesion using confocal laser scanning microscopy

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Dental Caries which has high prevalence rate, accounts for majority of dental diseases. Many treatment and preventive treatment has been developed, thereby reducing the prevalence rate.

As the dental caries progresses, irreversible damage of tooth structure occurs. In initial dental caries, demineralized tooth structure can be remineralized, and the restorative intervention is unnecessary.

In this study, 20 teeth restored with composite resin without fluoride release were used and divided into two groups. Incipient dental caries were artificially made and in each group, remineralization procedure was done for 1 and 2 weeks. Changes in mineral contents around the margins were analysed with confocal laser scanning microscope.

The results were as follow.

1. In both groups, total fluorescence of the lesion and average fluorescence of the lesion of remineralized samples decreased compared with demineralized state. ($p < 0.01$)
2. Confocal laser scanning microscopy can be used in quantitative analysis of changes of mineral contents in the dental caries lesions.

As a summary, confocal laser scanning microscopy can be used in quantitative analysis of mineral change and it may be used in many different fields of dentistry in the near future.

Key Word: Confocal laser scanning microscopy, Demineralization, Remineralization, Initial dental caries